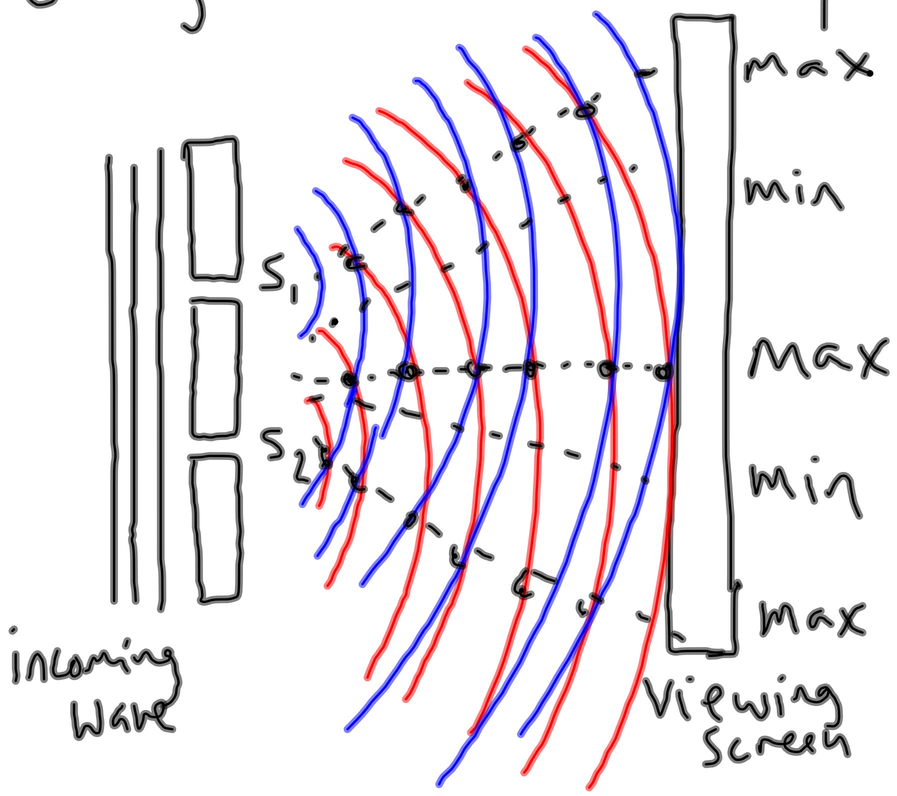
HW: p. 1068: 1, 2, 4, 5

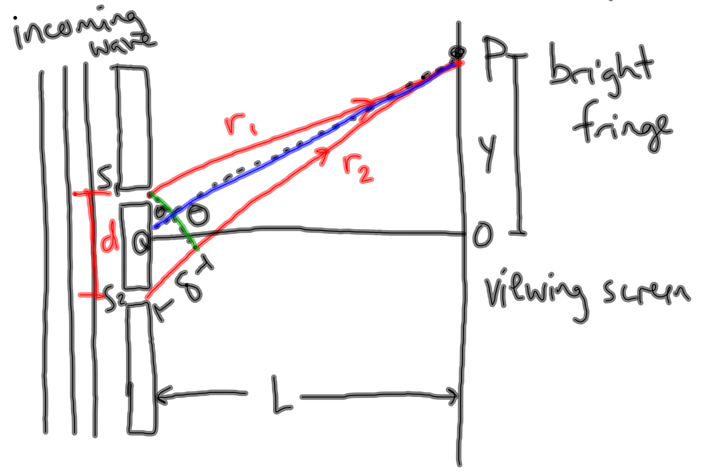
Test Wednesday, 2/22

Diffraction: "spreading" of light as it travels

Young's Double-Slit Experiment



Interference Mathmatically:



Path difference: $\delta = r_2 - r_1 = d\sin\theta$

Approximation: $L \gg d$

bright fringes (constructive interference points)

$$d \sin\theta_{bright} = m\lambda$$

$$m = 0, \pm 1, \pm 2, \pm 3, \ldots$$

dark fringes (destructive int.)

$$d \sin\theta_{dark} = \left(m + \tfrac{1}{2}\right)\lambda$$

$$m = 0, \pm 1, \pm 2, \pm 3, \ldots$$

We can write from QOP triangle

$$\tan\theta = \frac{y}{L}$$

$$y_{bright} = L \tan\theta_{bright}$$

$$y = L \tan\theta$$

Another approximation:

For small angles ($\theta < 10^\circ$),

$\tan\theta \approx \sin\theta$.

$$y_{bright} = L\left(\frac{m\lambda}{d}\right)$$

[only valid for small angles]

A light source emits visible light of two wavelengths: lambda_1 = 430 nm and lambda_2 = 510 nm. The source is used in a double-slit interference experiment in which L = 1.50 m and d = 0.025 mm. Find the separation distance between the third-order bright fringes for the two wavelengths.

for $\lambda_1 = 430$ nm

$$y_{\lambda_1} = \frac{m L \lambda_1}{d}$$ use + or − 3

$$= 0.0774 \text{ m}$$

$$y_{\lambda_2} = \frac{m L \lambda_2}{d}$$

$$= 0.0918 \text{ m}$$

$$\Delta y = y_{\lambda_2} - y_{\lambda_1}$$

$$= 0.0144 \text{ cm}$$